

## SEQUENCE LISTING

<110> The University of North Carolina at Chapel Hill  
Liu, Jian

<120> PURIFIED AND ISOLATED HEPARAN SULFATE 3-O-SULFOTRANSFERASE  
ISOFORM 5 NUCLEIC ACIDS AND POLYPEPTIDES AND THERAPEUTIC AND  
SCREENING METHODS USING SAME

<130> 421/67/2

<150> US 60/394,199

<151> 2002-07-05

<160> 12

<170> PatentIn version 3.2

<210> 1

<211> 1041

<212> DNA

<213> Homo sapiens

<220>

<221> CDS

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1 5 10 15	
gga agc ctt gcc gtt ggg agt ctc ctg tat cta gtc gcc aga gtt ggg	96
Gly Ser Leu Ala Val Gly Ser Leu Tyr Leu Val Ala Arg Val Gly	
20 25 30	
agc ttg gat agg cta caa ccc att tgc ccc att gaa ggt cga ctg ggt	144
Ser Leu Asp Arg Leu Gln Pro Ile Cys Pro Ile Glu Gly Arg Leu Gly	
35 40 45	
gga gcc cgc act cag gct gaa ttc cca ctt cgc gcc ctg cag ttt aag	192
Gly Ala Arg Thr Gln Ala Glu Phe Pro Leu Arg Ala Leu Gln Phe Lys	
50 55 60	
cgt ggc ctg ctg cac gag ttc cgg aag ggc aac gct tcc aag gag cag	240
Arg Gly Leu Leu His Glu Phe Arg Lys Gly Asn Ala Ser Lys Glu Gln	
65 70 75 80	
gtt cgc ctc cat gac ctg gtc cag cag ctc ccc aag gcc att atc att	288
Val Arg Leu His Asp Leu Val Gln Gln Leu Pro Lys Ala Ile Ile Ile	
85 90 95	
ggg gtg agg aaa gga ggc aca agg gcc ctg ctt gaa atg ctg aac cta	336
Gly Val Arg Lys Gly Gly Thr Arg Ala Leu Leu Glu Met Leu Asn Leu	
100 105 110	
cat ccg gca gta gtc aaa gcc tct caa gaa atc cac ttt ttt gat aat	384
His Pro Ala Val Val Lys Ala Ser Gln Glu Ile His Phe Phe Asp Asn	
115 120 125	

gat gag aat tat ggt aag ggc att gag tgg tat agg aaa aag atg cct 432  
Asp Glu Asn Tyr Gly Lys Gly Ile Glu Trp Tyr Arg Lys Lys Met Pro  
130 135 140

ttt tcc tac cct cag caa atc aca att gaa aag agc cca gca tat ttt 480  
Phe Ser Tyr Pro Gln Gln Ile Thr Ile Glu Lys Ser Pro Ala Tyr Phe  
145 150 155 160

atc aca gag gag gtt cca gaa agg att tac aaa atg aac tca tcc atc 528  
Ile Thr Glu Glu Val Pro Glu Arg Ile Tyr Lys Met Asn Ser Ser Ile  
165 170 175

aag ttg ttg atc att gtc agg gag cca acc aca aga gct att tct gat 576  
Lys Leu Leu Ile Ile Val Arg Glu Pro Thr Thr Arg Ala Ile Ser Asp  
180 185 190

tat act cag gtg cta gag ggg aag gag agg aag aac aaa act tat tac 624  
Tyr Thr Gln Val Leu Glu Gly Lys Glu Arg Lys Asn Lys Thr Tyr Tyr  
195 200 205

aag ttt gag aag ctg gcc ata gac cct aat aca tgc gaa gtg aac aca 672  
Lys Phe Glu Lys Leu Ala Ile Asp Pro Asn Thr Cys Glu Val Asn Thr  
210 215 220

aaa tac aaa gca gta aga acc agc atc tac acc aaa cat ctg gaa agg 720  
Lys Tyr Lys Ala Val Arg Thr Ser Ile Tyr Thr Lys His Leu Glu Arg  
225 230 235 240

tgg ttg aaa tac ttt cca att gag caa ttt cat gtc gtc gat gga gat 768  
Trp Leu Lys Tyr Phe Pro Ile Glu Gln Phe His Val Val Asp Gly Asp  
245 250 255

cgc ctc atc acg gaa cct ctg cca gaa ctt cag ctc gtg gag aag ttc 816  
Arg Leu Ile Thr Glu Pro Leu Pro Glu Leu Gln Leu Val Glu Lys Phe  
260 265 270

cta aat ctg cct cca agg ata agt caa tac aat tta tac ttc aat gct 864  
Leu Asn Leu Pro Pro Arg Ile Ser Gln Tyr Asn Leu Tyr Phe Asn Ala  
275 280 285

acc aga ggg ttt tac tgc ttg cgg ttt aat att atc ttt aat aag tgc 912  
Thr Arg Gly Phe Tyr Cys Leu Arg Phe Asn Ile Ile Phe Asn Lys Cys  
290 295 300

ctg gcg ggc agc aag ggg cgc att cat cca gag gtg gac ccc tct gtc 960  
Leu Ala Gly Ser Lys Gly Arg Ile His Pro Glu Val Asp Pro Ser Val  
305 310 315 320

att act aaa ttg cgc aaa ttc ttt cat cct ttt aat caa aaa ttt tac 1008  
Ile Thr Lys Leu Arg Lys Phe Phe His Pro Phe Asn Gln Lys Phe Tyr  
325 330 335

cag atc act ggg agg aca ttg aac tgg ccc taa 1041  
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<210> 2  
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<212> PRT  
<213> Homo sapiens

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Gly Ser Leu Ala Val Gly Ser Leu Leu Tyr Leu Val Ala Arg Val Gly  
 20 25 30

Ser Leu Asp Arg Leu Gln Pro Ile Cys Pro Ile Glu Gly Arg Leu Gly  
 35 40 45

Gly Ala Arg Thr Gln Ala Glu Phe Pro Leu Arg Ala Leu Gln Phe Lys  
 50 55 60

Arg Gly Leu Leu His Glu Phe Arg Lys Gly Asn Ala Ser Lys Glu Gln  
 65 70 75 80

Val Arg Leu His Asp Leu Val Gln Gln Leu Pro Lys Ala Ile Ile Ile  
 85 90 95

Gly Val Arg Lys Gly Gly Thr Arg Ala Leu Leu Glu Met Leu Asn Leu  
 100 105 110

His Pro Ala Val Val Lys Ala Ser Gln Glu Ile His Phe Phe Asp Asn  
 115 120 125

Asp Glu Asn Tyr Gly Lys Gly Ile Glu Trp Tyr Arg Lys Lys Met Pro  
 130 135 140

Phe Ser Tyr Pro Gln Gln Ile Thr Ile Glu Lys Ser Pro Ala Tyr Phe  
 145 150 155 160

Ile Thr Glu Glu Val Pro Glu Arg Ile Tyr Lys Met Asn Ser Ser Ile  
 165 170 175

Lys Leu Leu Ile Ile Val Arg Glu Pro Thr Thr Arg Ala Ile Ser Asp  
 180 185 190

Tyr Thr Gln Val Leu Glu Gly Lys Glu Arg Lys Asn Lys Thr Tyr Tyr  
 195 200 205

Lys Phe Glu Lys Leu Ala Ile Asp Pro Asn Thr Cys Glu Val Asn Thr  
 210 215 220

Lys Tyr Lys Ala Val Arg Thr Ser Ile Tyr Thr Lys His Leu Glu Arg  
 225 230 235 240

Trp Leu Lys Tyr Phe Pro Ile Glu Gln Phe His Val Val Asp Gly Asp  
245 250 255

Arg Leu Ile Thr Glu Pro Leu Pro Glu Leu Gln Leu Val Glu Lys Phe  
260 265 270

Leu Asn Leu Pro Pro Arg Ile Ser Gln Tyr Asn Leu Tyr Phe Asn Ala  
275 280 285

Thr Arg Gly Phe Tyr Cys Leu Arg Phe Asn Ile Ile Phe Asn Lys Cys  
290 295 300

Leu Ala Gly Ser Lys Gly Arg Ile His Pro Glu Val Asp Pro Ser Val  
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Ile Thr Lys Leu Arg Lys Phe Phe His Pro Phe Asn Gln Lys Phe Tyr  
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Gln Ile Thr Gly Arg Thr Leu Asn Trp Pro  
340 345

<210> 3  
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<212> PRT  
<213> Homo sapiens

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Leu Val Pro Ser Arg Pro Ala Glu Leu Gly Gln Gln Glu Leu Leu Arg  
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Lys Ala Gly Thr Leu Gln Asp Asp Val Arg Asp Gly Val Ala Pro Asn  
35 40 45

Gly Ser Ala Gln Gln Leu Pro Gln Thr Ile Ile Ile Gly Val Arg Lys  
50 55 60

Gly Gly Thr Arg Ala Leu Leu Glu Met Leu Ser Leu His Pro Asp Val  
65 70 75 80

Ala Ala Ala Glu Asn Glu Val His Phe Phe Asp Trp Glu Glu His Tyr  
85 90 95

Ser His Gly Leu Gly Trp Tyr Leu Ser Gln Met Pro Phe Ser Trp Pro  
 100 105 110

His Gln Leu Thr Val Glu Lys Thr Pro Ala Tyr Phe Thr Ser Pro Lys  
 115 120 125

Val Pro Glu Arg Val Tyr Ser Met Asn Pro Ser Ile Arg Leu Leu Leu  
 130 135 140

Ile Leu Arg Asp Pro Ser Glu Arg Val Leu Ser Asp Tyr Thr Gln Val  
 145 150 155 160

Phe Tyr Asn His Met Gln Lys His Lys Pro Tyr Pro Ser Ile Glu Glu  
 165 170 175

Phe Leu Val Arg Asp Gly Arg Leu Asn Val Asp Tyr Lys Ala Leu Asn  
 180 185 190

Arg Ser Leu Tyr His Val His Met Gln Asn Trp Leu Arg Phe Phe Pro  
 195 200 205

Leu Arg His Ile His Ile Val Asp Gly Asp Arg Leu Ile Arg Asp Pro  
 210 215 220

Phe Pro Glu Ile Gln Lys Val Glu Arg Phe Leu Lys Leu Ser Pro Gln  
 225 230 235 240

Ile Asn Ala Ser Asn Phe Tyr Phe Asn Lys Thr Lys Gly Phe Tyr Cys  
 245 250 255

Leu Arg Asp Ser Gly Arg Asp Arg Cys Leu His Glu Ser Lys Gly Arg  
 260 265 270

Ala His Pro Gln Val Asp Pro Lys Leu Leu Asn Lys Leu His Glu Tyr  
 275 280 285

Phe His Glu Pro Asn Lys Lys Phe Phe Glu Leu Val Gly Arg Thr Phe  
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Asp Trp His  
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<210> 4  
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 <213> Homo sapiens

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 20 25 30

Leu Thr Ser Leu Tyr Val Phe Tyr Cys Leu Ala Glu Arg Cys Gln Thr  
 35 40 45

Leu Ser Gly Pro Val Val Gly Leu Ser Gly Gly Gly Glu Glu Ala Gly  
 50 55 60

Ala Pro Gly Gly Gly Val Leu Ala Gly Gly Pro Arg Glu Leu Ala Val  
 65 70 75 80

Trp Pro Ala Ala Ala Gln Arg Lys Arg Leu Leu Gln Leu Pro Gln Trp  
 85 90 95

Arg Arg Arg Arg Pro Pro Ala Pro Arg Asp Asp Gly Glu Glu Ala Ala  
 100 105 110

Trp Glu Glu Glu Ser Pro Gly Leu Ser Gly Gly Pro Gly Gly Ser Gly  
 115 120 125

Ala Gly Ser Thr Val Ala Glu Ala Pro Pro Gly Thr Leu Ala Leu Leu  
 130 135 140

Leu Asp Glu Gly Ser Lys Gln Leu Pro Gln Ala Ile Ile Ile Gly Val  
 145 150 155 160

Lys Lys Gly Gly Thr Arg Ala Leu Leu Glu Phe Leu Arg Val His Pro  
 165 170 175

Asp Val Arg Ala Val Gly Ala Glu Pro His Phe Phe Asp Arg Ser Tyr  
 180 185 190

Asp Lys Gly Leu Ala Trp Tyr Arg Asp Leu Met Pro Arg Thr Leu Asp  
 195 200 205

Gly Gln Ile Thr Met Glu Lys Thr Pro Ser Tyr Phe Val Thr Arg Glu  
 210 215 220

Ala Pro Ala Arg Ile Ser Ala Met Ser Lys Asp Thr Lys Leu Ile Val  
 225 230 235 240

Val Val Arg Asp Pro Val Thr Arg Ala Ile Ser Asp Tyr Thr Gln Thr  
245 250 255

Leu Ser Lys Arg Pro Asp Ile Pro Thr Phe Glu Ser Leu Thr Phe Lys  
260 265 270

Asn Arg Thr Ala Gly Leu Ile Asp Thr Ser Trp Ser Ala Ile Gln Ile  
275 280 285

Gly Ile Tyr Ala Lys His Leu Glu His Trp Leu Arg His Phe Pro Ile  
290 295 300

Arg Gln Met Leu Phe Val Ser Gly Glu Arg Leu Ile Ser Asp Pro Ala  
305 310 315 320

Gly Glu Leu Gly Arg Val Gln Asp Phe Leu Gly Leu Lys Arg Ile Ile  
325 330 335

Thr Asp Lys His Phe Tyr Phe Asn Lys Thr Lys Gly Phe Pro Cys Leu  
340 345 350

Lys Lys Ala Glu Gly Ser Ser Arg Pro His Cys Leu Gly Lys Thr Lys  
355 360 365

Gly Arg Thr His Pro Glu Ile Asp Arg Glu Val Val Arg Arg Leu Arg  
370 375 380

Glu Phe Tyr Arg Pro Phe Asn Leu Lys Phe Tyr Gln Met Thr Gly His  
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Asp Phe Gly Trp Asp Gly  
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<212> PRT  
<213> Homo sapiens

<400> 5

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Arg Leu Leu Pro Gln Pro Pro Pro Pro Pro Pro Val Arg Arg Lys  
20 25 30

Leu Ala Leu Leu Phe Ala Met Leu Cys Val Trp Leu Tyr Met Phe Leu  
 35 40 45

Tyr Ser Cys Ala Gly Ser Cys Ala Ala Ala Pro Gly Leu Leu Leu Leu  
 50 55 60

Gly Ser Gly Ser Arg Ala Ala His Asp Pro Pro Ala Leu Ala Thr Ala  
 65 70 75 80

Pro Asp Gly Thr Pro Pro Arg Leu Pro Phe Arg Ala Pro Pro Ala Thr  
 85 90 95

Pro Leu Ala Ser Gly Lys Glu Met Ala Glu Gly Ala Ala Ser Pro Glu  
 100 105 110

Glu Gln Ser Pro Glu Val Pro Asp Ser Pro Ser Pro Ile Ser Ser Phe  
 115 120 125

Phe Ser Gly Ser Gly Ser Lys Gln Leu Pro Gln Ala Ile Ile Ile Gly  
 130 135 140

Val Lys Lys Gly Gly Thr Arg Ala Leu Leu Glu Phe Leu Arg Val His  
 145 150 155 160

Pro Asp Val Arg Ala Val Gly Ala Glu Pro His Phe Phe Asp Arg Ser  
 165 170 175

Tyr Asp Lys Gly Leu Ala Trp Tyr Arg Asp Leu Met Pro Arg Thr Leu  
 180 185 190

Asp Gly Gln Ile Thr Met Glu Lys Thr Pro Ser Tyr Phe Val Thr Arg  
 195 200 205

Glu Ala Pro Ala Arg Ile Ser Ala Met Ser Lys Asp Thr Lys Leu Ile  
 210 215 220

Val Val Val Arg Asp Pro Val Thr Arg Ala Ile Ser Asp Tyr Thr Gln  
 225 230 235 240

Thr Leu Ser Lys Arg Pro Asp Ile Pro Thr Phe Glu Ser Leu Thr Phe  
 245 250 255

Lys Asn Arg Thr Ala Gly Leu Ile Asp Thr Ser Trp Ser Ala Ile Gln  
 260 265 270



Ile Gly Ile Tyr Ala Lys His Leu Glu His Trp Leu Arg His Phe Pro  
 275 280 285

Ile Arg Gln Met Leu Phe Val Ser Gly Glu Arg Leu Ile Ser Asp Pro  
 290 295 300

Ala Gly Glu Leu Gly Arg Val Gln Asp Phe Leu Gly Leu Lys Arg Ile  
 305 310 315 320

Ile Thr Asp Lys His Phe Tyr Phe Asn Lys Thr Lys Gly Phe Pro Cys  
 325 330 335

Leu Lys Lys Ala Glu Gly Ser Ser Arg Pro His Cys Leu Gly Lys Thr  
 340 345 350

Lys Gly Arg Thr His Pro Glu Ile Asp Arg Glu Val Val Arg Arg Leu  
 355 360 365

Arg Glu Phe Tyr Arg Pro Phe Asn Leu Lys Phe Tyr Gln Met Thr Gly  
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His Asp Phe Gly Trp Asp  
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 <212> DNA  
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<220>  
 <223> 5'-primer for exon 1 of human 3-OST-5

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 ggagggccat gctattcaaa cag

23

<210> 7  
 <211> 21  
 <212> DNA  
 <213> Artificial

<220>  
 <223> 3'-primer for exon 2 of human 3-OST-5

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21

<210> 8  
 <211> 27  
 <212> DNA  
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<220>  
 <223> 5'-primer for amplification of human 3-OST-5 in pGEM-T-3OST5  
  
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 <211> 27  
 <212> DNA  
 <213> Artificial  
  
 <220>  
 <223> 3'-primer for amplification of human 3-OST-5 in pGEM-T-3OST5  
  
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 <210> 10  
 <211> 343  
 <212> PRT  
 <213> Artificial  
  
 <220>  
 <223> C-terminal portion of human 3-OST-5 linked to honeybee melittin  
 signal sequence for incorporation in baculovirus expression  
 plasmid  
  
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 Ser Tyr Ile Tyr Ala Asp Arg Trp Ile Pro Arg Val Gly Ser Leu Asp  
 20 25 30  
  
 Arg Leu Gln Pro Ile Cys Pro Ile Glu Gly Arg Leu Gly Gly Ala Arg  
 35 40 45  
  
 Thr Gln Ala Glu Phe Pro Leu Arg Ala Leu Gln Phe Lys Arg Gly Leu  
 50 55 60  
  
 Leu His Glu Phe Arg Lys Gly Asn Ala Ser Lys Glu Gln Val Arg Leu  
 65 70 75 80  
  
 His Asp Leu Val Gln Gln Leu Pro Lys Ala Ile Ile Ile Gly Val Arg  
 85 90 95  
  
 Lys Gly Gly Thr Arg Ala Leu Leu Glu Met Leu Asn Leu His Pro Ala  
 100 105 110  
  
 Val Val Lys Ala Ser Gln Glu Ile His Phe Phe Asp Asn Asp Glu Asn  
 115 120 125

Tyr Gly Lys Gly Ile Glu Trp Tyr Arg Lys Lys Met Pro Phe Ser Tyr  
 130 135 140

Pro Gln Gln Ile Thr Ile Glu Lys Ser Pro Ala Tyr Phe Ile Thr Glu  
 145 150 155 160

Glu Val Pro Glu Arg Ile Tyr Lys Met Asn Ser Ser Ile Lys Leu Leu  
 165 170 175

Ile Ile Val Arg Glu Pro Thr Thr Arg Ala Ile Ser Asp Tyr Thr Gln  
 180 185 190

Val Leu Glu Gly Lys Glu Arg Lys Asn Lys Thr Tyr Tyr Lys Phe Glu  
 195 200 205

Lys Leu Ala Ile Asp Pro Asn Thr Cys Glu Val Asn Thr Lys Tyr Lys  
 210 215 220

Ala Val Arg Thr Ser Ile Tyr Thr Lys His Leu Glu Arg Trp Leu Lys  
 225 230 235 240

Tyr Phe Pro Ile Glu Gln Phe His Val Val Asp Gly Asp Arg Leu Ile  
 245 250 255

Thr Glu Pro Leu Pro Glu Leu Gln Leu Val Glu Lys Phe Leu Asn Leu  
 260 265 270

Pro Pro Arg Ile Ser Gln Tyr Asn Leu Tyr Phe Asn Ala Thr Arg Gly  
 275 280 285

Phe Tyr Cys Leu Arg Phe Asn Ile Ile Phe Asn Lys Cys Leu Ala Gly  
 290 295 300

Ser Lys Gly Arg Ile His Pro Glu Val Asp Pro Ser Val Ile Thr Lys  
 305 310 315 320

Leu Arg Lys Phe Phe His Pro Phe Asn Gln Lys Phe Tyr Gln Ile Thr  
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Gly Arg Thr Leu Asn Trp Pro  
 340

<210> 11  
 <211> 33  
 <212> DNA

<213> Artificial

<220>

<223> 5' primer for amplification by PCR of N-terminal portion of human  
3-OST-5

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33

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<211> 25

<212> DNA

<213> Artificial

<220>

<223> 3' primer for amplification by PCR of N-terminal portion of human  
3-OST-5

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25